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LOPEZ, OLVIN	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/736,983	TOMOYASU ET AL.	
	Examiner	Art Unit	
	OLVIN LOPEZ	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-53* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-53* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/17/203, 05/09/2005, 10/09/2008*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

No Priority has been claimed in this application.

Specification

Title

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. Claims are directed to a method of processing a substrate and an apparatus for treating a substrate. The following title is suggested by the examiner **"Method and system for performing a chemical oxide removal process".**

Claim Objections

1. Claims 5 objected to because of the following informalities:

Claim 5, line 2, recite "SEM". Abbreviation or acronyms appearing for the first time in a claim should be defined.

1. Claim 1 recites the limitation **"output state"** in line 1. There is insufficient antecedent basis for this limitation in the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 9-13, 22-30, 32 and 41-42 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 9-13, 22-30, 32 , recites “approximately” within them. This term renders the claims indefinite.

Claims 41-42, recites “substantially”. This term renders the claims indefinite.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. **Claims 1-12, 14-17, 19-23, 26, 31-33, 35, 37-44, and 46-53 are rejected under 35 U.S.C. 102(e) as being anticipated by Verbeke et al in (US 20030045131).**

With respect to claim 1, Verbeke teaches a method of processing a substrate by chemical oxide removal (COR) **(see title and paragraphs [0059] lines 9-10 and [0064] wafers are expose to hydrogen peroxide and) comprising**:

determining a desired state for the substrate, wherein the output state comprises at least one target critical dimension (CD) **(see fig 8A element 841 report Critical dimension CD, and paragraph [0082] lines 1-8);**

receiving pre-process metrology data for the substrate **(see Fig 8A element 810),** wherein the pre-process metrology data defines an input state for the wafer and comprises pre-process CD data (see Fig. 8A element 830, and paragraph [0080] lines 1-4, [0082] lines1-9);

determining a process recipe by comparing the input state with the desired state **(see fig 8a elements 840-880 the target and reference states of a wafer are compared and a recipe is determined to continue processing the wafer if needed, see paragraphs [0083]-[0090] for the whole process, see specifically paragraph [0090])** ; and

processing the substrate using the process recipe by chemically altering exposed surface layers on the substrate and then thermally treating the chemically altered surface layers **(see paragraph [0061] lines 1-5 , [0062] and [0063] lines 1-2, see paragraph [0090] "to determine the etch recipe at step 880, said recipe used to adjust the etch processing of the lot" the).**

With respect to claim 2, Verbeke teaches the method of processing a substrate as claimed in claim 1, the method further comprising:

Verbeke further teaches receiving post-process metrology data for the substrate, wherein the post-process metrology data defines an output state and comprises CD data for a processed substrate **(see Fig 8A elements 860 and 880 paragraph [0065]) ;**

determining if the desired state has been achieved **(see paragraph [0084] "the target feature is imaged by imager 710 at step 830, and its waveform is stored as a target waveform see paragraph", [0102] lines 29-46 and see figs. 10A-10E critical dimension of an isolated or nested data is produced from the images taken from the features 1004. if the measurements taken are out of compliance the wafer is processed until complies with a target feature).**

determining a new process recipe when the desired state has not been achieved **(see Fig. 8A element 880);** and

transferring the substrate when the desired state has been achieved **(see paragraph [0103] lines 1-3 "If the CD measurements of wafer 1000 are found to be in compliance with desired results, then wafer 1000 is removed from CD module 700 and brought into transfer chamber 610 by robot 612").**

With respect to claim 3, Verbeke teaches the method of processing a substrate as claimed in claim 1, **Verbeke further teaches** wherein the pre-process

metrology data comprises Optical Digital Profiling (ODP) data **(see paragraph [0079] Optical imager 710 can utilize scatterometry or reflectometry techniques which are ODP).**

With respect to claim 4, Verbeke teaches the method of processing a substrate as claimed in claim 1, wherein the post-process metrology data comprises Optical Digital Profiling (ODP) data **(see paragraph [0079] Optical imager 710 can utilize scatterometry or reflectometry techniques which are ODP see Fig. 8A. a feedback and feed-forward of data).**

With respect to claim 5, Verbeke teaches the method of processing a substrate as claimed in claim 4, **Verbeke further teaches** wherein the post-process metrology data comprises SEM data **(see paragraph [0081] imager can be a CD SEM).**

With respect to claim 6, Verbeke teaches the method of processing a substrate as claimed in claim 1, **Verbeke further teaches** wherein the pre-process metrology data comprises at least one to-be-controlled CD and the process recipe is determined by comparing the at least one to-be- controlled CD to the target CD **(see paragraph [0078] the width of photo-resist feature formed on an incoming wafer and see fig 8a elements 840-880 the target and reference states of a wafer are compared and a recipe is determined to continue processing the wafer if needed,**

see paragraphs [0083]-[0090] for the whole process, see specifically paragraph [0090]).

With respect to claim 7, Verbeke teaches the method of processing a substrate as claimed in claim 6, **Verbeke further teaches** wherein the at least one to-be-controlled CD is larger than the target CD and the processing includes performing a trimming process **(see fig. 10A and 10B).**

With respect to claim 8, Verbeke teaches the method of processing a substrate as claimed in claim 7, wherein the trimming process comprises:

Verbeke further teaches executing a chemical oxide removal (COR) process recipe for a COR module, wherein exposed surfaces on a substrate are chemically treated using the process gas **(see paragraph [0106]),** wherein a solid reaction product is formed on at least one exposed surface **(see Figs. 10A- 10E see paragraph [0102] and [0144] "FIG. 14A-14C show chamber body 1445 that defines reaction chamber 1490 in which the thermal decomposition of a process gas or gases takes place to form a film on a wafer e.g., a CVD reaction");** and

executing a post heat treatment (PHT) process recipe for a PHT module by executing comprises evaporating the solid reaction product, thereby trimming the chemically treated exposed surface layers **(see Figs. 10A- 10 E and [0063]);**

With respect to claim 9, Verbeke teaches the method of processing a substrate as claimed in claim 8, further comprising:

Verbeke further teaches repeating the COR process recipe executing and the PHT process recipe executing until the at least one to-be-controlled CD is approximately equal to the target CD **(see paragraph [0102] lines 30-46).**

With respect to claim 10, Verbeke teaches the method of processing a substrate as claimed in 9, further comprising:

Verbeke further teaches receiving post-process metrology data, wherein the post-process metrology data defines an output state and comprises measured CD data for a processed substrate **(see paragraph [0102] lines 30-46)**;

determining if the measured CD is approximately equal to the target CD **(see figs 8A and 8B and paragraph [0102]);**

repeating the COR process recipe executing and the PHT process recipe executing when the measured CD is not approximately equal to the target CD **(see figs 8A and 8B and paragraph [0102]);** and

stopping the execution steps when the measured CD is approximately equal to the target CD **(see figs 8A and 8B and paragraph [0102] as its is shown in Figs. 8A and 8B the method of processing a wafer is repeated until a predetermined threshold value is approximately reached also see [0103] If the CD measurements of wafer 1000 are found to be in compliance with desired results,**

then wafer 1000 is removed from CD module 700 and brought into transfer chamber 610 by robot 612).

With respect to claim 11, Verbeke teaches the method of processing a substrate as claimed in claim 7, **Verbeke teaches** further comprising determining a trimming amount (**see paragraph [0080] and [0102] the optical imager 710 measures CD and profile of certain patterns on photo resist layer ... when these CD measurements are out of compliance the method of Figs. 8A-8B is performed),** wherein the trimming process **(see paragraph [0102] –[103])** includes :

executing a chemical oxide removal (COR) process recipe for a COR module **(see paragraph [0104]),** wherein exposed surfaces on a substrate are chemically treated using a process gas **(see Fig. 4 or Fig. 9 these chambers ca be used for the trimming process)**, wherein a solid reaction product having a thickness approximately equal to the trimming amount is formed on at least one exposed surface; and

executing a post heat treatment (PHT) process recipe for a PHT module by evaporating the solid reaction product **(see Figs. 10A- 10E see paragraph [0102] and [0059] A cleaning process may be performed in the cleaning chamber 400 by exposing the substrate 480 to energized process gas comprising cleaning gas to, for example, remove remnant resist and/or to remove or inactivate etchant residue remaining on the substrate after the substrate is etched");**

thereby trimming at least one of the chemically treated exposed surfaces by the trimming amount **(see Figs 10A to 10E).**

With respect to claim 12, Verbeke teaches the method of processing a substrate as claimed in claim 11, further comprising:

examining a number of pre-qualified control recipes, wherein each control recipe has a pre-determined trim value **(see paragraph [0082] and see fig. 8A);** and selecting the control recipe having a pre-determined trim value approximately equal to the difference between the pre-process CD data and the target CD **(see paragraph [0082] and see figs. 8A and 8B)**.

With respect to claim 14, Verbeke teaches the method of processing a substrate as claimed in claim 11, further comprising:

creating a lookup table containing a number of recipes **(see paragraph [0082] "a reference library is created");** and

performing a table lookup to determine the process recipe **(see paragraph [0123] "The change in process parameters would be determined by complex controller 124 from a stored look up table or formula which relates the process parameters to the particle scan of wafer 1600"). It is obvious that if the controller accesses a look up table to access information on parameters, first the controller or user had to have created the look up table for predetermined recipes with acceptable values as shown in step 810.**

With respect to claim 15, Verbeke teaches the method of processing a substrate as claimed in claim 8, wherein the executing a COR process recipe comprises:

transferring the substrate into a module comprising a chemical treatment chamber **(see fig. 9 substrate 930 is placed in holder 940);**

positioning the substrate on a temperature controlled substrate holder mounted within the chemical treatment **chamber (see fig. 9 element support 940 for holding wafer 930 and see paragraph [0095]) ;**

altering the chamber pressure using a vacuum pumping system coupled to the chemical treatment chamber **(see fig. 9 element 962 and see paragraph [096] lines 1-6 and [0099] "A throttle valve 200 is provided in the exhaust for controlling the pressure in chamber 910");**

providing the process gas using a gas distribution system coupled to the chemical treatment chamber and configured to introduce a process gas into the chemical treatment chamber **(see fig. 9 element 964);** and

controlling the COR module, the temperature controlled substrate holder, the vacuum pumping system, and the gas distribution system according to the process recipe **(see paragraph [0105] lines 6-9, [0114] lines 4-6, [0185] and [0245] Processor 720 executes the system control software and provides and receives control signals for the tool which controls the transfer of wafers through the tool and which provides the specific control signals necessary to achieve the specific processing parameters for each of the modules coupled to**

the tool, such as process temperature, process gas/fluid flows and process pressure. Also as shown in Figs. 8A and 8B only where there is a difference between the target and the measured CD the system will modify the recipes already store for every process (etch, stripping, trimming etc) and the parameters for every step might be changed accordingly).

With respect to claim 16, Verbeke teaches the method of processing a substrate as claimed in claim 8, wherein the executing a PHT process recipe comprises:

transferring the substrate into a module comprising a thermal treatment chamber; positioning the substrate on a temperature controlled substrate holder mounted within the thermal treatment chamber **(see paragraph [136] lines 1-3 and Fig. 13A elements substrate 1361, holder 1362, and rotating cylinder 1363 substrate is positioned on holder 1362 and see paragraph [0182] and [0183]);**

altering the chamber temperature using a temperature controlled upper assembly coupled to the thermal treatment chamber **(see paragraph [0191] lines 1-5 and Fig. 13A elements 1319);**

altering the chamber pressure using a vacuum pumping system coupled to the thermal treatment chamber **(see Fig. 14 element 1431 and paragraph [0149] and [0190] “pressure is pumped down”**); and

controlling the PHT module, the vacuum pumping system, temperature control system, and the temperature controlled substrate holder according to the process

recipe **(see paragraph [0105] lines 6-9, [0114] lines 4-6, [0185] and [0245] Processor 720 executes the system control software and provides and receives control signals for the tool which controls the transfer of wafers through the tool and which provides the specific control signals necessary to achieve the specific processing parameters for each of the modules coupled to the tool, such as process temperature, process gas/fluid flows and process pressure. Also as shown in Figs. 8A and 8B only where there is a difference between the target and the measured CD the system will modify the recipes already store for every process (etch, stripping, trimming etc) and the parameters for every step might be changed accordingly).**

(the method of using apparatus 1200 shown in figs. 12 to 16D is explained in paragraphs [0180]-[0222]).

With respect to claim 17, Verbeke teaches the method of processing a substrate as claimed in claim 8, **Verbeke further teaches** wherein the exposed surface comprises hard mask material **(see paragraph [0102] line 14).**

With respect to claim 19, Verbeke teaches the method of processing a substrate as claimed in claim 15, **Verbeke further teaches** wherein the process gas comprises a fluorine-containing gas and a nitrogen- containing gas **(see paragraph [0062] lines 9-11).**

With respect to claim 20, Verbeke teaches the method of processing a substrate as claimed in claim 19, **Verbeke further teaches** wherein the process gas comprises HF and NH3 **(see paragraph [0062] lines 9-11 "NH3" and paragraph [0108] lines 13-14 any gas or vapor containing hydrogen can serve as a gas and [0053] cleaning chemicals such as diluted HF).**

With respect to claim 21, Verbeke teaches the method of processing a substrate as claimed in claim 8, **Verbeke further teaches** wherein the process gas comprises a first gas and a second gas that are independently introduced to a processing space **(see paragraph [0147] lines 1-7 also see Fig. 2A).**

With respect to claim 22, Verbeke teaches the method of processing a substrate as claimed in claim 15, **Verbeke further teaches** wherein the temperature of the temperature controlled substrate holder in the chemical treatment chamber ranges from approximately 10° C to approximately 50° C **(see paragraph [0106] the holder acts as a cathode with a temperature of about 50° C).**

With respect to claim 23, Verbeke teaches the method of processing a substrate as claimed in claim 15, **Verbeke further teach** wherein the temperature of the substrate mounted on the temperature controlled substrate holder in the chemical treatment chamber ranges from approximately 10° C to approximately 50° C **(see paragraph [0218] lines 19-21).**

With respect to claim 26 and 32, Verbeke teaches the method of processing a substrate as claimed in claim 15, **Verbeke further teaches** further comprising controlling the temperature of a chemical treatment chamber wall within a range from approximately 30° to approximately 100° C **(see paragraph [0141] lines 10-12).**

With respect to claim 31, Verbeke teaches the method of processing a substrate as claimed in claim 16, further comprising:

Verbeke further teaches positioning the substrate at a first distance from the temperature controlled upper assembly during a first time **(see paragraph [0146])**; and

positioning the substrate at a second distance from the temperature controlled upper assembly during a second time **(see paragraph [0150] , also as it is shown in Figs. 8A-8B in all of the process steps, after a wafer has been processed it can be sent to the metrology apparatus and if the desired output has not been achieved the wafer is reprocessed and sent back to the process chamber see paragraph [0185]).**

With respect to claim 33, Verbeke teaches the method of processing a substrate as claimed in claim 1, **Verbeke further teaches** wherein the pre-process metrology data comprises an isolated CD data for at least one isolated feature and nested CD data for at least one nested feature, and the process recipe is determined

by comparing the isolated CD data and the nested CD data to the target CD **(see paragraph [0084] "the target feature is imaged by imager 710 at step 830, and its waveform is stored as a target waveform see paragraph", [0102] lines 29-46 and see figs. 10A-10E critical dimension of an isolated or nested data is produced from the images taken from the features 1004. if the measurements taken are out of compliance the wafer is processed until complies with a target feature).**

With respect to claim 35, Verbeke teaches the method of processing a substrate as claimed in claim 33, further comprising:

Verbeke further teaches determining a first delta based on the difference between CD data for a first feature and the target CD data **(see paragraph [0085] lines 9-11 and [0086]);**

determining a second delta based on the difference between CD data for a second feature and the target CD data **(see paragraph [0085] 11-14 and [0086]);** and

performing a trimming process based on the difference between the first delta and the second delta **(see paragraph [0086] lines 6-13 se fig 8A and 10B).**

With respect to claim 37, Verbeke teaches the method of processing a substrate as claimed in claim 1, further comprising:

Verbeke further teaches receiving post-process metrology data for the substrate, wherein the post-process metrology data defines an output state and

comprises CD data for a processed substrate **(see Fig 8A elements 860 and 880 paragraph [0065] and [0086] lines 1-6)**;

computing a predicted state for the wafer based on the process characteristics and a process model **(see paragraph [0088] lines 10-12) ;**

determining if the predicted state has been achieved by comparing the output sate with the predicted state **(see paragraph [0090]);** and

computing a process model offset when the predicted state has not been achieved **(see paragraph [0086] and [0087] lines 1-4 and [0090] also see fig. 8A and 8B adjustments are made to the recipe when differences are found between the averaged value of a lot or several wafers and the next wafer).**

With respect to claim 38, Verbeke teaches the method of processing a substrate as claimed in claim 1, **Verbeke further teaches** wherein the process recipe is determined by executing a control strategy and a control plan **(see paragraph [0091] lines 1-6).**

With respect to claim 39, Verbeke teaches the method of processing a substrate as claimed in claim 8, further comprising:

Verbeke further teaches transferring the substrate from the COR module to the PHT module **(See paragraph [0102] lines 43-46 [0104], [0105] wafer is etched and [0141] lines 1-7).**

With respect to claim 40, Verbeke teaches a processing system for treating a substrate comprising **(see paragraph [0045]):**

Verbeke teaches a processing subsystem comprising a chemical oxidation removal (COR) module for chemically altering exposed surface layers on the substrate **(see fig. 12 element 200 and figs. 15A-15E and paragraph [0182]),** a post heat treatment (PHT) module for thermally treating the chemically altered surface layers on the substrate **(see [00131] lines 1-3),** and an isolation assembly coupled between the PHT module and the COR module **(see fig. 12 the isolation assembly is taught as the transfer chamber 1224);**

a first integrated metrology module (IMM) coupled to the processing subsystem for providing pre-process metrology data that determines an input state for the substrate **(see fig. 12 element 1290, see paragraph [0126] lines 10 integrated thickness monitoring tool);** and

a control device coupled to the processing subsystem and the first IMM **(see fig. 12 element 124)** , wherein the control device determines a process recipe for changing the wafer from the input state to the desired state; and executes the process recipe **(see paragraph [0123] "information gained from the surface monitoring can be used by controller 124 to determine the process parameters for stripping the silicon nitride 1604 on subsequent wafers and can be used to determine cleaning parameters for cleaning subsequent wafer in wet cleaning module 200 and see**

paragraph [0245] FIG. 20A illustrates a computer/controller 124 which can be used to control the movement and processing of a wafer in a tool, such as tool 100, 600, 1200 and 1800 in accordance with the present invention).

With respect to claim 41, Verbeke teaches the processing system for treating a substrate as claimed in claim 40, **Verbeke further teaches** wherein the COR module further comprises a temperature controlled chemical treatment chamber **(see fig. 12 element 1400 and see Figs. 14A-14B and see paragraph [0144] lines 8-12),** a temperature controlled substrate holder mounted within the chemical treatment chamber and configured to be substantially thermally insulated from the chemical treatment chamber **(see Fig. 14A and 14B see [0144] "resistive heater 1480 holding susceptor 1405 holds a substrate also see paragraph" [0152] lines 9-17 and [0154] "pyrometers provides data about the surface of the susceptor"),** a vacuum pumping system coupled to the chemical treatment chamber **(see fig. 14A element 1431)**, and a temperature controlled gas distribution system for introducing one or more process gases into the chemical treatment chamber **(see Fig. 14A element gas mixing).**

With respect to claim 42, Verbeke teaches the processing system for treating a substrate as claimed in claim 40, **Verbeke further teaches** wherein the PHT module further comprises a temperature controlled thermal treatment chamber **(see fig.13A and paragraph [0027]),** a temperature controlled substrate holder mounted within the

thermal treatment chamber and configured to be substantially thermally insulated from the thermal treatment chamber **(see paragraph [136] lines 1-3 and fig. 13A elements substrate 1361, holder 1362, and rotating cylinder 1363 made of quartz which is a known insulator),** and a vacuum pumping system coupled to the thermal treatment chamber **(see fig. 13A element 1353)**.

With respect to claim 43, Verbeke teaches the processing system for treating a substrate as claimed in claim 40, **Verbeke further teaches** wherein the control means further comprises means for controlling at least one of a chemical treatment chamber temperature, a chemical treatment gas distribution system temperature, a chemical treatment substrate holder temperature, a chemical treatment substrate temperature, a chemical treatment processing pressure, a chemical treatment gas flow rate, a thermal treatment chamber temperature, a thermal treatment substrate holder temperature, a thermal treatment substrate temperature, and a thermal treatment processing pressure **(see paragraph [0245] lines 1-3 and 14-17).**

With respect to claim 44, Verbeke teaches the processing system for treating a substrate as claimed in claim 40, **Verbeke further teaches** wherein the isolation assembly comprises at least one of a thermal insulation assembly, a gate valve assembly, and a transfer system **(see fig. 12 the isolation assembly comprises transfer chamber 1224 and transfer mechanism 1226);**

With respect to claim 46, Verbeke teaches the processing system for treating a substrate as claimed in claim 41, **Verbeke further teaches** wherein the temperature controlled gas distribution system comprises at least one gas distribution plate, the gas distribution plate comprising one or more gas injection orifices **(see Fig. 14A element gas mixing and element 1420 and see paragraph [0145] and [0147] blocker plate 1424 to distribute the gas and perforated plate 1425 distribute the gas about an area consistent with the surface area of a wafer).**

With respect to claim 47, Verbeke teaches the processing system for treating a substrate as claimed in claim 41, **Verbeke further teaches** wherein the temperature controlled substrate holder in the chemical treatment chamber comprises at least one of an electrostatic clamping system, a back-side gas supply system, and one or more temperature control elements **(see paragraphs [0095] "electrostatic chuck 950 with grooves 955 in which a coolant gas, such as helium, is held to control the temperature of the substrate 930" and [0154] lines 10-19 "pyrometers provides data about the surface of the susceptor" and also a thermocouple 1470).**

With respect to claim 48, Verbeke teaches the processing system for treating a substrate as claimed in claim 41, **Verbeke further teaches** wherein the temperature controlled substrate holder in the chemical treatment chamber includes one or more temperature control elements **(see paragraph [0154] lines 10-19 "pyrometers**

provides data about the surface of the susceptor" and also a thermocouple 1470).

With respect to claim 49, Verbeke teaches the processing system for treating a substrate as claimed in claim 41, **Verbeke further teaches** wherein the gas distribution system comprises a first gas distribution plenum and a first gas distribution plate having a first array of one or more orifices and a second array of one or more orifices for coupling the first gas to the process space through the first array of one or more orifices in the first gas distribution plate, and a second gas distribution plenum and a second gas distribution plate having passages therein for coupling the second gas to the process space through the passages in the second gas distribution plate and the second array of one or more orifices in the first gas distribution plate **(see paragraph [0145] and [0147] "The first gas distribution plate 1424, when coupled to the gas sources trough port 1420, forms a first gas distribution plenum. Additionally, the second gas distribution plate 1425, when coupled to the first gas distribution plate 1424 forms a second gas distribution plenum").**

With respect to claim 50, Verbeke teaches the processing system for treating a substrate as claimed in claim 49, wherein the first gas and the second gas are independently introduced to the process space (see paragraph [0147] and paragraph [0217] lines 1-10).

With respect to claim 51, Verbeke teaches the processing system for treating a substrate as claimed in claim 42, **Verbeke further teaches** wherein the PHT module further comprises a substrate lifter assembly coupled to the thermal treatment chamber for vertically translating the substrate between a transfer plane and the substrate holder **(see paragraph [0146] lines 1-12 "specifically line 11 recites a lifter assembly 1460").**

With respect to claim 52, Verbeke teaches the processing system as recited in claim 40, **Verbeke further teaches** wherein the processing subsystem is coupled to a manufacturing system **(see paragraph [0079] lines 1-11 and [0246]).**

With respect to claim 53, Verbeke teaches the processing system as recited in claim 40, **Verbeke further teaches** wherein the control means also determines if the desired state has been achieved **(see paragraph [0123] lines 14-26 and [0245]).**

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Shoham et al (US 7042564).

With respect to claim 13, Verbeke teaches the method of processing a substrate as claimed in claim 11, further comprising:

Verbeke teaches creating a binning table, each bin containing a pre-determined trim value **(see paragraph [0082] "a reference library is created");**

selecting the bin having a pre-determined trim value approximately equal to the difference between the pre-process CD data and the target CD **(see paragraph [0123] "The change in process parameters would be determined by complex controller 124 from a stored look up table or formula which relates the process parameters to the particle scan of wafer 1600"). It is obvious that if the controller accesses a look up table to access information on parameters, first the controller or user had to have created the look up table or formula for predetermined recipes with acceptable values as shown in step 810)**; and

selecting the pre-qualified control recipe associated with the bin as the process recipe

(see Figs. 8A and 8B a recipe is selected if the measured feature matches the target feature). **Verbeke does no teach** this table or formula is a binning table. **Shoham teaches** a method of inspecting a wafer using an algorithm which include generating a reference wafer and generating a grid of bins to compute a standard deviation in each bin to control the polishing of a wafer **(see abstract, see Figs. 3A-3C, see Col 12 lines 31-33 ad lines 49-53, Col 14 lines 15-20 and lines 39-51, and Table 2 teaches the bins).** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a method of inspecting a wafer using an algorithm which include generating a reference wafer and generating a grid of bins to compute a standard deviation in each bin as taught by Shoham to control the polishing of a wafer **(see abstract, see Figs. 3A-3C, see Col 12 lines 31-33 ad lines 49-53, Col 14 lines 15-20 and lines 39-51, and Table 2 teaches the bins).**

6. **Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Wise et al (US 6903023).**

With respect to claim 18, Verbeke teaches the method of processing a substrate as claimed in claim 8, wherein the exposed surface comprises oxidized TERA material. **Wise et al** 6903023 teaches a hard mask material such as TERA to enable patterning directly **(see Col 1 lines 14-20).** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a hard mask

material such as TERA **as taught by Wise** to enable patterning directly **(see Col 1 lines 14-20).**

7. **Claims 23-24, and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Ishikawa et al (US 5240556).**

With respect to claim 23, Verbeke teaches the method of processing a substrate as claimed in claim 15, **Verbeke does not teach** wherein the temperature of the substrate mounted on the temperature controlled substrate holder in the chemical treatment chamber ranges from approximately 10° C to approximately 50° C**. Ishikawa teaches** the temperature of the substrate mounted on the temperature controlled substrate holder in the chemical treatment chamber is heated at about at least room temperature (approx 23 C) to prevent the surface of the semiconductor wafer from attachments of droplets when the semiconductor is unloaded in the air **(see Col 3 lines 21-26).** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have kept the temperature of the substrate mounted on the temperature controlled substrate holder in the chemical treatment chamber heated at about at least room temperature (approx 23 C) **as taught by Ishikawa to** prevent the surface of the semiconductor wafer from attachments of droplets when the semiconductor is unloaded in the air **(see Col 3 lines 21-26).**

With respect to claims 24 and 29, Verbeke teaches the method of processing a substrate as claimed in claim 15 and claim 16, **Verbeke does not teach** wherein the chemical treatment chamber pressure ranges from approximately 1 mTorr to approximately 100 mTorr**. Ishikawa teaches** the chemical treatment chamber pressure is kept at low-pressure atmosphere (e.g. 75 mTorr) **(see Col 7 lines 37-42)** for activating an etching gas activated in a low-pressure atmosphere. It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have kept the chemical treatment chamber pressure at low-pressure atmosphere (e.g. 75 mTorr) **(see Col 7 lines 37-42)** as taught for Ishikawa for activating an etching gas activated in a low-pressure atmosphere **(see Col 3 lines 36-39).**

With respect to claim 28, Verbeke teaches the method of processing a substrate as claimed in claim 16, **Verbeke does not teach** wherein the temperature of the substrate mounted on the temperature controlled substrate holder in the thermal treatment chamber ranges from approximately 10° C to approximately 50° C. **Ishikawa teaches** The object is preferably heated at a temperature falling within a range of 50 to 100.degree. C. because carbon tetrachloride gas (CCl.sub.4) as one of the etching gases used for etching of the object has a relatively low boiling point, the etching gas deposited on the surface of the object can be sufficiently discharged by heating at the above temperature and also since a normal photo resist has a heat resistance of 120 to 140.degree. C., the resist is not thermally affected by heating at the **temperature**

(see Col 3 lines 51-61). It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have kept the substrate heated at a temperature falling within a range of 50 to 100.degree. C. **as taught by Ishikawa** because carbon tetrachloride gas (CCl.sub.4) as one of the etching gases used for etching of the object has a relatively low boiling point, the etching gas deposited on the surface of the object can be sufficiently discharged by heating at the above temperature and also since a normal photo resist has a heat resistance of 120 to 140.degree. C., the resist is not thermally affected by heating at the **temperature (see Col 3 lines 51-61).**

8. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke in view of Wang et al in (US 5354715).

With respect to claim 25, Verbeke teaches the method of processing a substrate as claimed in claim 15, Verbeke teaches temperature controlled conduits. However, **Verbeke does not teach** further comprising controlling the temperature of the process gas in the gas distribution system within a range from approximately 30° to approximately 100° C. Wang teaches a temperature controlled gas distribution system that controls the temperature of the gas inside there within a range of 35 to 75 to avoid the condensation and reactions of the gas inside the distribution system **(see Fig. 12 and Col 10 lines 61-68 and Col 11 lines 11-13 also see line 45 and line 62 and see Col 18 lines 5-18).** It would have been obvious at the time the invention was made to a

person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a temperature controlled gas distribution system that controls the temperature of the gas inside there within a range of 35 to 75 Celsius degrees **as taught by Wang** to avoid the condensation and reactions of the gas inside the distribution system **(see Fig. 12 and Col 10 lines 61-68 and Col 11 lines 11-13 also see line 45 and line 62 and see Col 18 lines 5-18).**

9. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke in view of Kawakami et al in (US 5542559).

With respect to claim 27, Verbeke teaches the method of processing a substrate as claimed in claim 16, **Verbeke does not teach** wherein the temperature of the temperature controlled substrate holder in the thermal treatment chamber ranges from approximately 10° C to approximately 50° C. Kawakami teaches a plasma treatment apparatus that maintains the temperature of a substrate holder in a range of 10 to -100 (which falls in the above range) degree in order to prevent any possible electrical discharge between a lower electrode and a grounded member during a plasma etching **process (see abstract and Col 1 lines 9-65 and Col 6 lines 57-62).** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a plasma treatment apparatus that maintains the temperature of a substrate holder in a range of 10 to -100 (which falls in the above range) degree **as taught by Kawakami** in order to prevent any possible electrical discharge between

a lower electrode and a grounded member during a plasma etching **process (see abstract and Col 1 lines 9-65 and Col 6 lines 57-62).**

10. **Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Yamazaki et al in (US 6803246).**

With respect to claim 30, Verbeke teaches the method of processing a substrate as claimed in claim 16, **Verbeke does not teach** wherein the temperature of the thermal treatment chamber ranges from approximately 10° C to approximately 50° C. **Yamakazi teaches** a thermal treatment chamber wherein the temperature ranges from approximately 10° C to approximately 50° **(see Col 21 claim 5)** to process a substrate. It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a thermal treatment chamber wherein the temperature ranges from approximately 10° C to approximately 50° **(see Col 21 claim 5)** as taught by Yamazaki to process a substrate.

11. **Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Official Notice Taken.**

With respect to claim 34, Verbeke teaches the method of processing a substrate as claimed in claim 33, further comprising:

Verbeke further teaches performing a first trimming process based on the difference between the isolated CD data and the target CD data **(see Fig. 10B and**

paragraph [0104]); and

performing a second trimming process based on the difference between the nested CD data and the target CD data **(see Fig. 10B and paragraph [0104]) ;** **Verbeke teaches the method of comparing** wherein the pre-process metrology data comprises an isolated CD data for at least one isolated feature and nested CD data for at least one nested feature, and the process recipe is determined by comparing the isolated CD data and the nested CD data to the target CD **(see paragraph [0084] "the target feature is imaged by imager 710 at step 830, and its waveform is stored as a target waveform see paragraph", [0102] lines 29-46 and see figs. 10A-10E critical dimension of an isolated or nested data is produced from the images taken from the features 1004. if the measurements taken are out of compliance the wafer is processed until complies with a target feature. Verbeke further teaches a well known method of trimming a feature of a wafer to reduce its dimension (as shown in Fig. 10B). It was well know in the art at the time of the invention that a trimming process to reduce the dimension of a critical dimension or gate line width would increase a microchip functionality Official notice Taken.** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have used the target feature data compared against an isolated feature data to perform a first trimming process on a wafer as shown in fig 10 B, and also have used the target feature data against a nested feature data to perform a second trimming process on a wafer as shown in fig 10 B

since the trimming process is well known in the art that can increase the functionality of a microchip (wafer).

12. **Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Chondroudis et al in (US 20040071888).**

With respect to claim 36, Verbeke teaches the method of processing a substrate as claimed in claim 33, Verbeke teaches wherein the pre-process metrology data includes goodness-of-fit (GOF) data, and depth data **(paragraph [0055] integrate particle monitor to determine the shape of a wafer and, [0126] an integrated thickness monitoring tool 1290 to [0180] "measure of the deposited gate film on the wafer the thickness of a wafer" see also [0185] lines 1-6).** However , **Verbeke does not teach** that the pre-process metrology data includes goodness of fit.

Chondroudis teaches a method for measuring the thickness of a film using **goodness of fit** data to compare the spectra model to extract the refractive index and thickness of each spectra collected and to identify films having desirable properties **(see paragraphs [0002] lines 6-9 and [0130]).** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a technique for measuring the thickness of a film using **goodness of fit** data **as taught Chondroudis** by to compare the spectra model to extract the refractive index and thickness of each spectra collected to identify films having desirable properties **(see paragraphs [0002] lines 6-9 and [0130]).**

13. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbeke et al in view of Rice et al in (US 5477975).

With respect to claim 45, Verbeke teaches the processing system for treating a substrate as claimed in claim 41, **Verbeke further teaches** wherein the temperature controlled chemical treatment chamber comprises a wall heating element **(see paragraph [0144] heater 1480). Verbeke does not teach** said heating element is a wall heating element. **Rice teaches** a wall heating element to maintain the temperature of sidewalls to eliminate the problem of deposition and vaporizations on a quartz sidewall **(see Col 3 lines 16-25).** It would have been obvious at the time the invention was made to a person of ordinary skill in the art to which said subject matter pertains to have modified Verbeke's invention and have used a wall heating element as taught by Rice to maintain the temperature of sidewalls and eliminate the problem of deposition and vaporizations on a quartz sidewall **(see Col 3 lines 16-25).**

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The reference Okano (US 5591486) teaches a "Method for forming a film on a substrate by activating a reactive gas" that comprises two chambers a chemical treatment chamber and a thermal treatment chamber, gas distribution system and so on.

The reference Ritzdorf (US 20030020928) teaches "Methods and apparatus for processing microelectronic work pieces using metrology" that discloses all the subject matter of claims 1 and 40.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **OLVIN LOPEZ** whose telephone number is (571)270-7686. The examiner can normally be reached on Mondays thru Thursdays and alternate Fridays from 7:30 A.M. to 5:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Albert Decady,** can be reached on (571)-272-3819. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/O. L./
Examiner, Art Unit 2121

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